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ABSTRACT

Using SAT scores as a means of controlling for student input, three different statistical methods were used to estimate the relative productivity of various curriculum groups. Subjects were 873 University of Delaware seniors for whom both SAT scores and UP (Undergraduate Program) Area Test scores were available. The Area Test scores administered toward the end of the senior year were used as the criteria of achievement in social science, humanities and natural science. This study shows that knowledge in these three principal areas of academic learning is, at least in part, dependent on the characteristics of the curriculum in which a student is enrolled. (Author/MJM)

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ACADEMIC GROWTH IN SOCIAL SCIENCE, HUMANITIES AND NATURAL SCIENCE IN VARIOUS CURRICULUM GROUPS

Carol Pemberton, Ph.D.

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Academic Planning and Evaulation
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ABSTRACT

Using SAT-scores as a means of controlling for student input, three different statistical methods were used to estimate the relative productivity of various curriculum groups. Subjects were 873 seniors for whom both SAT-scores and UP Area Test scores were available. The Area Test scores administered towards the end of the senior year were used as the criteria of achievement in social science, humanities and natural science. This study shows that knowledge in these three principal areas of academic learning is, at least in part, dependent on the characteristics of the curriculum in which a student is enrolled. If initial ability is controlled, the students with the greatest exposure to social science courses (Social Science and Business and Economics majors) make the best scores in this area. Students with the greatest exposure to humanities courses (Humanities and Education majors) make better-than-predicted scores in this field. Students with the greatest exposure to the natural sciences (Biology and Agriculture majors) scored higher than anticipated on the Natural Science test. Physical Science majors, perhaps due to their high SAT standing, did not score better than predicted on the Natural Science test. Only Social Science majors yielded average UP Area Test scores higher than would have been predicted from their average SAT scores, by all three procedures. Engineering majors scored lower than originally predicted on the Humanities Area Test.

Academic Growth in Social Science, Humanities and Natural Science in Various Curriculum Groups

Introduction

It is usually argued that, regardless of major field, every college graduate should have some knowledge in the three principal areas of learning: the social sciences, the humanities, and the natural sciences. To appraise student achievement in these three general areas, the University of Delaware has administered the Area Tests of the Graduate Record Examinations Institutional Program, now known as the Undergraduate Program, to its seniors classes each year from 1960 through 1971. National and local norms have been made available each year, to help interpret senior scores. These norms, however, do not reveal to what extent achievement in the three areas is due to the academic ability and prior achievement of the students, and how much can be attributed to the type of curriculum and instruction received. A study done by the author in 1970 came to the conclusion that student achievement in the senior year was more dependent on variations in student characteristics as sophomores,[1] than upon the characteristics of the curriculum in which they were enrolled. Astin came to a similar conclusion concerning undergraduate achievement and institutional "excellence".[2] Beanblossom, on the basis of a correlational study relating credit hours taken in the social sciences, humanities, and natural sciences to CLEP General Examination scores, states that "the evidence fails to show that repeated exposure to social

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[1] Pemberton, Carol. The Relationship between Grades and Two External Measures of Academic Achievement. University Impact Study, University of Delaware, Newark, Del. March 1970.

[2] Astin, Alexander W. Undergraduate Achievement and Institutional "Excellence." Science, August 16, 1968, 161, pp. 661-668.

science and humanities courses greatly increses knowledge in these areas."[1] His use of the word "increases" can be questioned since he did not have a measure of initial level of competence.

The present study uses three different statistical methods of controlling for student input, in an attempt to account for the relative productivity of various curriculum groups independent of student talent. Freshman academic aptitude test scores were used as predictors for each method, and senior UP Area Test scores as criteria.

Procedure

i) Stanine Difference Method

Of the 1261 seniors who took the Area Tests in the Undergraduate Program at the University of Delaware in April, 1971, scores were available on the Verbal and Mathematics sections of the Scholastic Aptitude Test (SAT-V and SAT-M for 873 of them. Ideally, freshman achievement in the social sciences, humanities and natural sciences should have been used as predictors, but very few students had achievement test scores in all three of these areas. The present study is a truly longitudinal one, in that all the students in it had both sets of scores, and that all the students had attended the University of Delaware for four academic years.

Distributions for the SAT-V, SAT-M, the average SAT scores, the UP Social Science, Humanities, Natural Science, and average Area Test scores were prepared for the 873 subjects. From these distributions all scores were

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[1] Beanblossom, Gary F. The Use of CLEP Scores in Evaluating Liberal Arts Curriculum. Bureau of Testing, University of Washington, Seattle, Wa. Mar. 1969. pg. 12. ERIC Document Reproduction Service, ED 029 598

converted into stanines, which are 9-point normalized standard scores, with a mean of 5, and a standard deviation of 2. Direct comparisons between the scores can be made when they have all been converted into standard score form using the same population for the conversion. Correlations between the SAT scores and the Area Test scores were calculated, and appear in Table 1.

Table 1

Correlations between SAT and Area Test Scores (N=873)

Test	S.S.	Hum.	N.S.	UP-AV
SAT-V	.58	.63	.48	.72
SAT-M	.37	.19	.56	.49
SAT-AV	.55	.47	.60	.70

In the stanine difference method the SAT-V scores were used for the predictors of both the Social Science and Humanities Area Test scores, the SAT-M for the Natural Science score, and the SAT-average for the Area Test-average. Change in the relative position of the various curriculum groups should indicate which curricula were most successful in bringing about change in their students, and in what areas. The average Area Test stanines, SAT stanines, and the differences between the two are shown in Table 2 for the twelve curriculum groups. The last column in this table, headed "p-value," gives the level of significance for all differences significant at the .05 level or better. Figure 1 shows the freshman and senior profiles[1] graphically, the SAT-V stanine appearing twice the

[1] The profile for the Health Science curriculum group was not shown graphically as there were only eight people in this curriculum group.

Table 2

CHANGE IN SAT AND UGRE STANINES
BETWEEN THE 1967 and 1971 ADMINISTRATIONS

Curriculum Group	N	UGRE Test *	1971 Stan.	SAT Test	1967 Stan.	d	p-value
Biology	36	S.S.	5.75	V	6.08	-.33	n.s.
		Hum.	6.17	V	6.08	.09	n.s.
		N.S.	7.67	M	6.58	1.09	.002
		Av.	6.92	Av.	6.56	.36	n.s.
Physical Science	50	S.S.	5.52	V	5.88	-.36	n.s.
		Hum.	5.30	V	5.88	-.58	.05
		N.S.	6.52	M	6.84	-.32	n.s.
		Av.	6.02	Av.	6.52	-.50	.05
Humanities	99	S.S.	4.81	V	5.72	-.91	.002
		Hum.	6.85	V	5.72	1.13	.002
		N.S.	4.31	M	4.59	-.28	n.s.
		Av.	5.36	Av.	5.17	.19	n.s.
Social Science	149	S.S.	5.93	V	5.28	.65	.002
		Hum.	5.66	V	5.28	.38	.02
		N.S.	4.69	M	4.79	-.10	n.s.
		Av.	5.55	Av.	4.86	.69	.002
Agriculture	41	S.S.	3.56	V	3.78	-.22	n.s.
		Hum.	3.34	V	3.78	-.44	n.s.
		N.S.	5.68	M	4.07	1.61	.002
		Av.	4.07	Av.	3.76	.31	n.s.
Business & Econ.	139	S.S.	5.44	V	4.32	1.12	.002
		Hum.	3.78	V	4.32	-.54	.002
		N.S.	4.28	M	4.96	-.68	.002
		Av.	4.38	Av.	4.56	-.16	n.s.
Education	118	S.S.	3.97	V	4.61	-.64	.002
		Hum.	5.31	V	4.61	.70	.002
		N.S.	4.33	M	3.95	.38	.02
		Av.	4.35	Av.	4.16	.19	n.s.
Engineering	93	S.S.	5.31	V	5.41	-.10	n.s.
		Hum.	4.33	V	5.41	-1.08	.002
		N.S.	6.72	M	6.87	-.15	n.s.
		Av.	5.71	Av.	6.25	-.54	.002
Health Science	8	S.S.	4.13	V	6.63	-2.50	.002
		Hum.	6.00	V	6.63	-.63	n.s.
		N.S.	6.75	M	6.25	.50	n.s.
		Av.	5.88	Av.	6.75	-.87	n.s.
Home Economics	75	S.S.	4.55	V	4.91	-.36	.05
		Hum.	4.69	V	4.91	-.22	n.s.
		N.S.	4.56	M	4.69	-.13	n.s.
		Av.	4.55	Av.	4.79	-.24	n.s.
Nursing	34	S.S.	3.50	V	4.38	-.88	.02
		Hum.	4.03	V	4.38	-.35	n.s.
		N.S.	4.85	M	3.79	1.06	.002
		Av.	3.85	Av.	4.00	-.15	n.s.
Physical Education	31	S.S.	2.71	V	3.35	-.64	.05
		Hum.	3.03	V	3.35	-.32	n.s.
		N.S.	3.52	M	3.67	-.15	n.s.
		Av.	2.81	Av.	3.35	-.54	n.s.

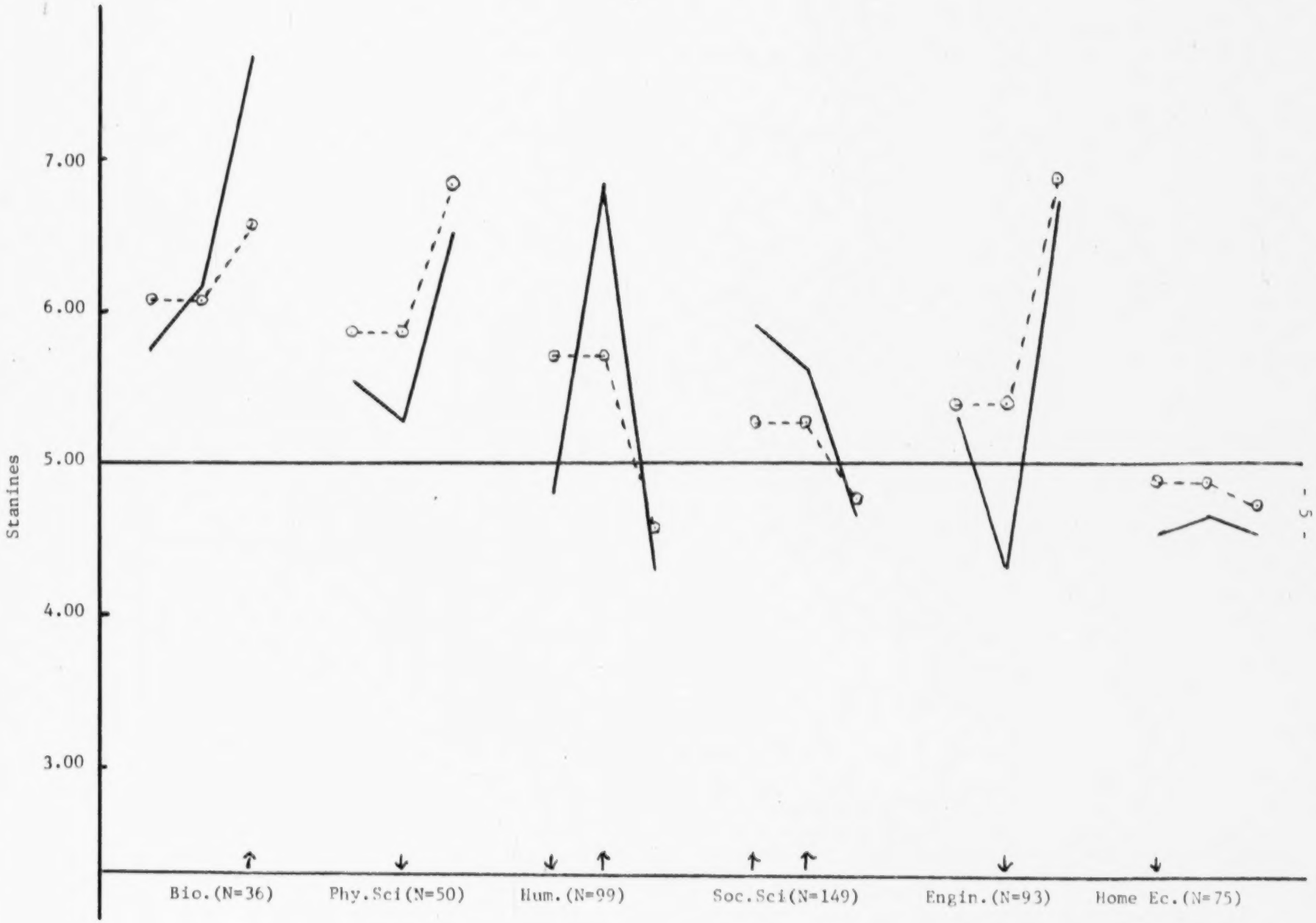

Fig. 1. Freshman SAT-Profiles and Senior UP-Profiles (See legend on continuation of Fig. 1 on next page.)

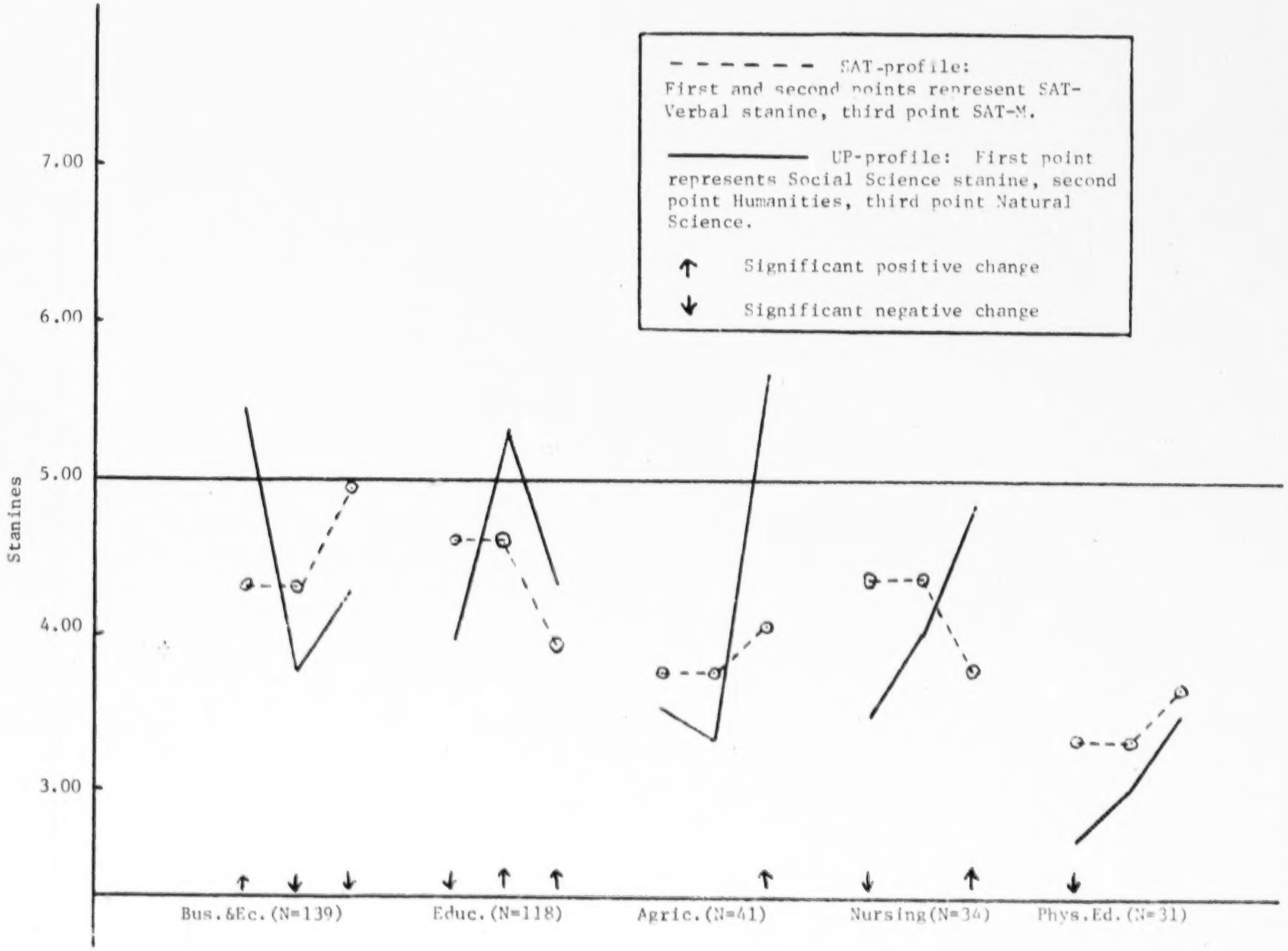

Fig. 1. (continued)

freshman profile, followed by the SAT-M stanine. The SAT-Averages and the UP-Averages have not been plotted in this figure. Changes in the stanine scores which were significant at the .05 level or better are indicated by arrows, an arrow pointing upward indicating a relative improvement in standing between the freshman and senior scores, an arrow pointing downward indicating a drop in standing compared with other curricula.

Results

1) Stanine Difference Method

From Table 2 and Figure 1[1] it can be seen that scores which were significantly higher than predicted at the .05 level or better using the stanine difference method were:

The Social Science score for Social Science and Business and Economic majors;

The Humanities score for Humanities and Education majors;

The Natural Science score for Biology, Agriculture, Education and Nursing majors;

The Area Test average score for Social Science majors.

Scores that were significantly lower than predicted at the .05 level or better by this method were:

The Social Science score for Education, Humanities, Physical Education, Home Economics, Health Science, and Nursing;

The Humanities Score for Physical Science, Business and Economics, and Engineering;

The Natural Science score for Business and Economics;

The Area Test Average score for Physical Science, and Engineering.

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[1] The profile for the Health Science curriculum group was not shown graphically as there were only eight people in this curriculum group.

Procedure

ii) Regression Equation Method Using Group Means

The mean SAT and UP scores for each of twelve curriculum groups and the standard deviations for these twelve scores are shown in Table 3. The intercorrelations between the curriculum group means (N=12) appear in Table 4. From these correlations and standard deviations the regression equations of the UP scores on the SAT scores were calculated. These are shown in Table 5.

Since the mean SAT-V score predicted the mean Humanities score best, SAT-M predicted the mean Social Science and the mean Natural Science scores best, and the SAT average predicted the Area Test average best, these four regression equations were calculated. Since SAT-V had been used for predicting Social Science scores in the stanine method, this regression equation was also calculated. From these equations regression lines were drawn, which are shown in Figures 2 through 6. The position of each curriculum group in terms of its mean scores, was plotted about the regression line. The thin lines parallel to the regression line have been drawn one standard error of estimate above and below it.

Results

ii) Regression Equation Method Using Group Means

From Figures 2 through 6 it can be seen that the curriculum groups that were more than one standard error of estimate above the regression line (i.e. performed significantly better than predicted) were:

Humanities and Education for the regression of UP Humanities on SAT-Verbal;

Social Science for the regression of UP-Social Science on SAT-Mathematics; and Social Science, and Business and Economics for the regression of UP-Social Science on SAT-Verbal.

Biology and Agriculture for the regression of UP-Natural Science on SAT-Mathematics.

Biology and Social Science for the regression of the UP-Average on SAT-Average.

The curriculum groups that were one standard error of estimate or more below the regression line (i.e. performed less well than predicted) were:

Engineering and Health Science for the regression of UP-Humanities on SAT-Verbal;

Health Science and Physical Education for the regression of UP-Social Science on SAT-Mathematics, and Health Science for the regression of UP-Social Science on SAT-Verbal;

None for the regression of UP-Natural Science on SAT-Mathematics;

Physical Education for the regression of UP-Average on SAT-Average.

Procedure

iii) Regression Equation Method Using Individual Scores

The regressions of each of the three Area Tests and the Area Test average on SAT-V, SAT-M and SAT-Average were calculated using the correlations and standard deviations obtained from the individual scores. Separate regression equations were calculated for the total class, Arts and Science majors, majors in the professional curricula, and for eleven curriculum groups. Eight Health Science majors were included in the calculations for the total class, but were not included in the professional total or as a separate curriculum, because of the small number of cases involved. The correlations and regression equations calculated by the individual-score method appear in Tables 6-9. From these equations the regression lines for the total group, and each curriculum group were drawn. For ease of interpretation only selected regression equations have been reproduced in Figures 7 through 10. In these figures the regression lines

Table 3

Mean SAT and Area Test Scores for Various Curricula

Curriculum	N	SAT V	SAT M	SAT Av.	UGRE S.S	UGRE Hum.	UGRE N.S	UGRE Av.
Biology	36	582	636	609	540	545	675	587
Phys. Sci.	50	572	652	612	526	507	608	547
Humanities	99	567	545	556	491	580	491	521
Social Sci.	149	551	559	555	580	533	505	539
Agriculture	41	479	524	501	434	419	561	471
Bus. & Econ	139	499	561	530	524	436	488	482
Education	118	516	515	516	451	503	491	482
Engineering	93	549	648	598	517	462	623	534
Health Sci.	8	611	615	613	468	533	619	540
Home Econo.	75	525	552	538	475	477	503	485
Nursing	34	510	511	510	429	448	512	463
Phys. Educ.	31	458	507	482	395	402	450	416
M		535	569	552	486	487	544	506
S.D.		42.1	49.6	40.4	49.8	53.7	66.5	40.0

Table 4

Correlations between the Curriculum Group Mean Scores (N=12)

Test	UGRE S.S.	UGRE Hum	UGRE N.S	UGRE Av.
SAT-V	.56	.88	.65	.83
SAT-M	.70	.43	.86	.79
SAT-Av.	.66	.70	.84	.89

Table 5

Regression Equations Using the Group-Mean Method

Regression	r	Equation: Y=	S.E
SAT-M on UP-SS	.70	.7028 X +86.1	35.6
SAT-V on UP-Hum.	.88	1.1224 X -113.5	25.5
SAT-M on UP-NS	.86	1.1530 X -112.1	33.9
SAT-V on UP-SS	.56	.6624 X +131.6	41.3
SAT-Av. on UP-Av.	.89	.8812 X +19.58	18.2

Table 6

Regression Equations of UP - Social Science on SAT-V for Various Curriculum Groups and the Total

Group	N	r	Equation: Y =	S.E.
Humanities	99	.68	.7242 X +81.0	73.8
Social Science	149	.54	.5918 X +253.7	83.1
Biology	36	.61	.6574 X +157.4	71.0
Physical Sci.	50	.60	.5591 X +206.2	77.1
Agriculture	41	.64	.5232 X +183.4	53.7
Business & Ec.	139	.50	.5944 X +226.7	73.8
Education	118	.64	.7279 X +75.5	59.5
Engineering	93	.67	.7160 X +123.7	69.7
Home Economics	75	.56	.5425 X +189.9	57.9
Nursing	34	.67	.4417 X +203.5	36.8
Physical Educ.	31	.68	.7549 X +49.3	60.7
Arts & Sci. Total	334	.53	.5911 X +209.0	88.9
Professional Total	531	.57	.6492 X +146.4	73.2
Grand Total	873[1]	.58	.6619 X +150.4	81.1

1 8 Health Science majors included in Grand Total

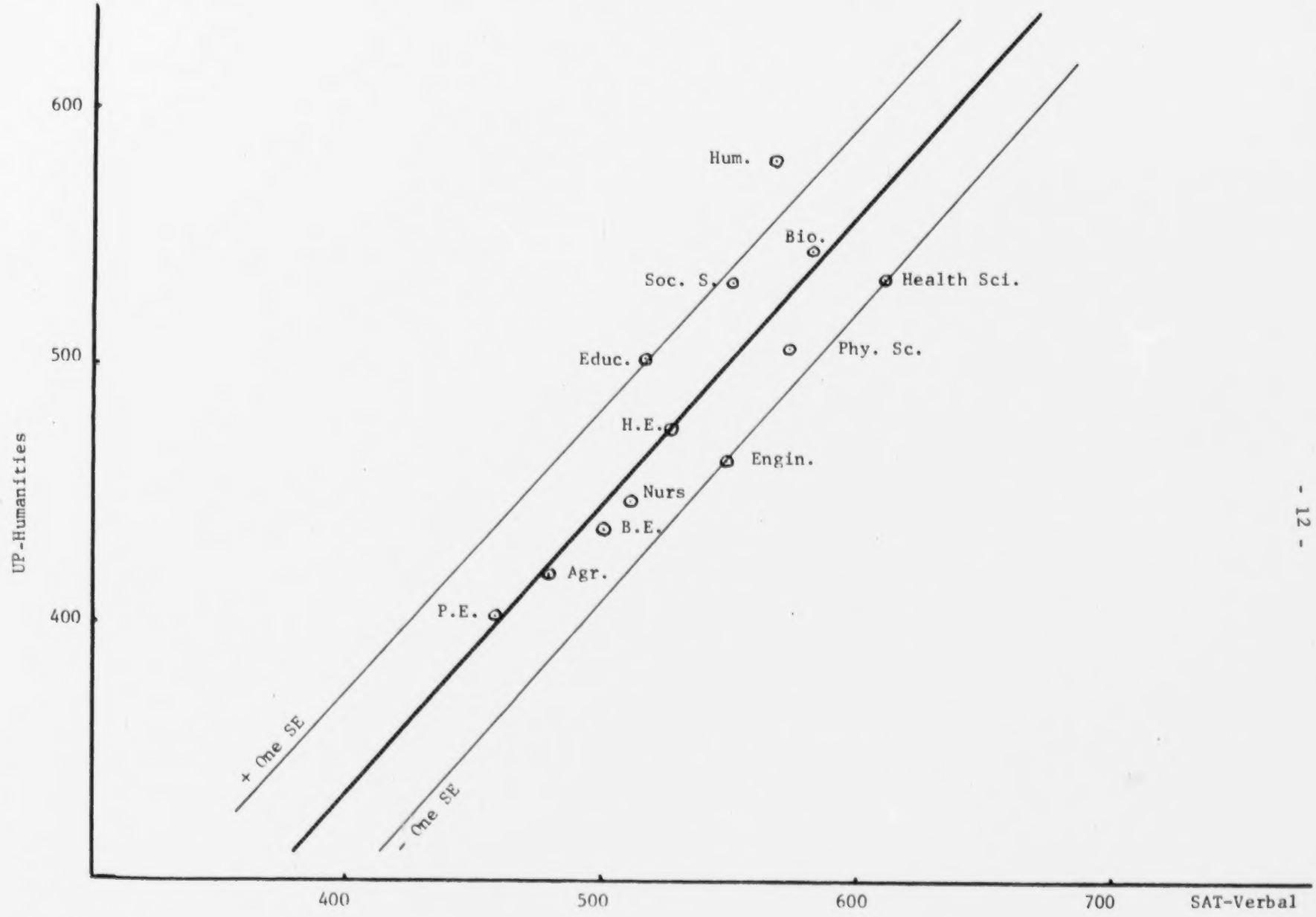

Fig. 2. Regression of UP-Humanities on SAT-Verbal

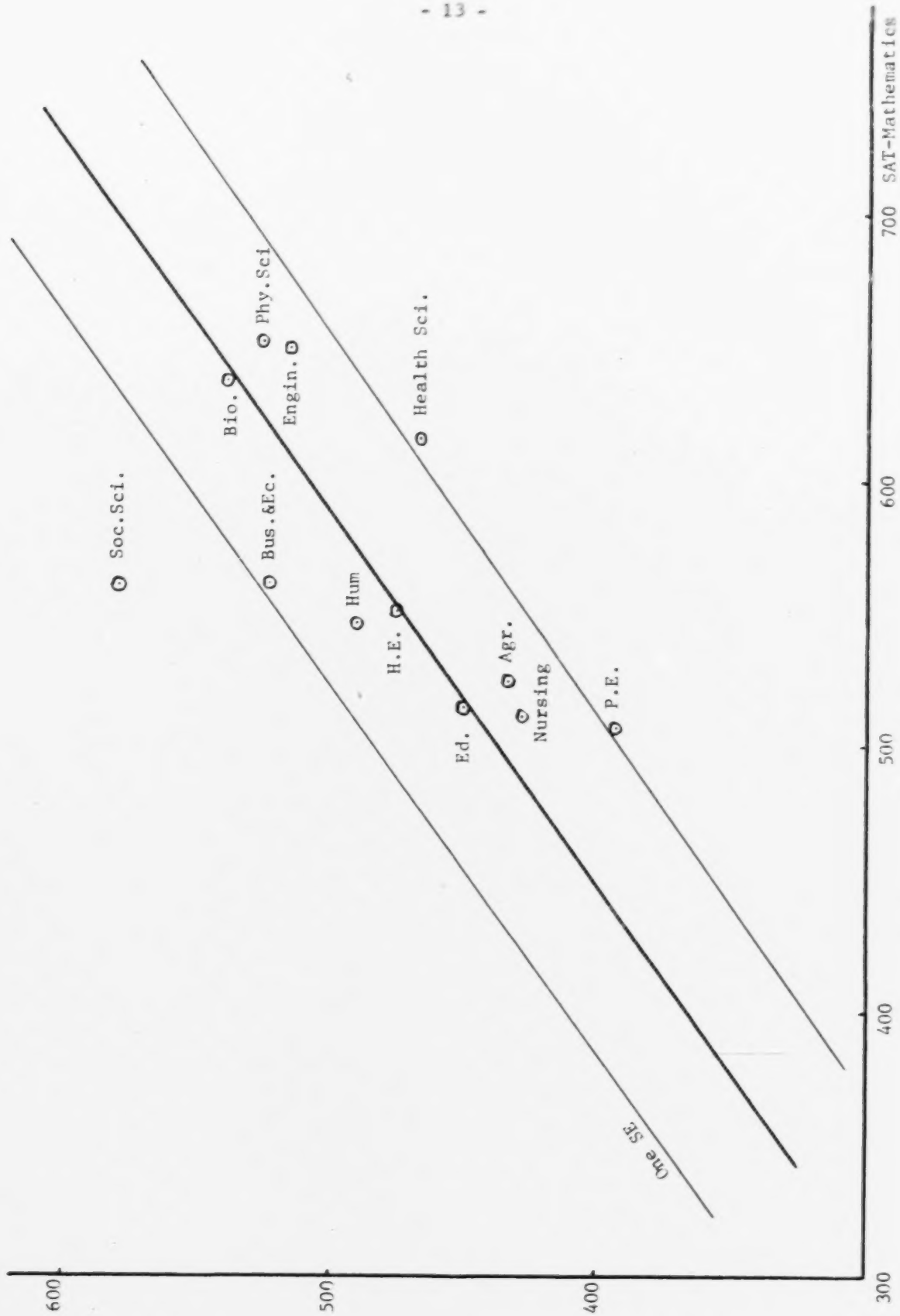

Fig. 3. Regression of UP-Social Science on SAT-Mathematics

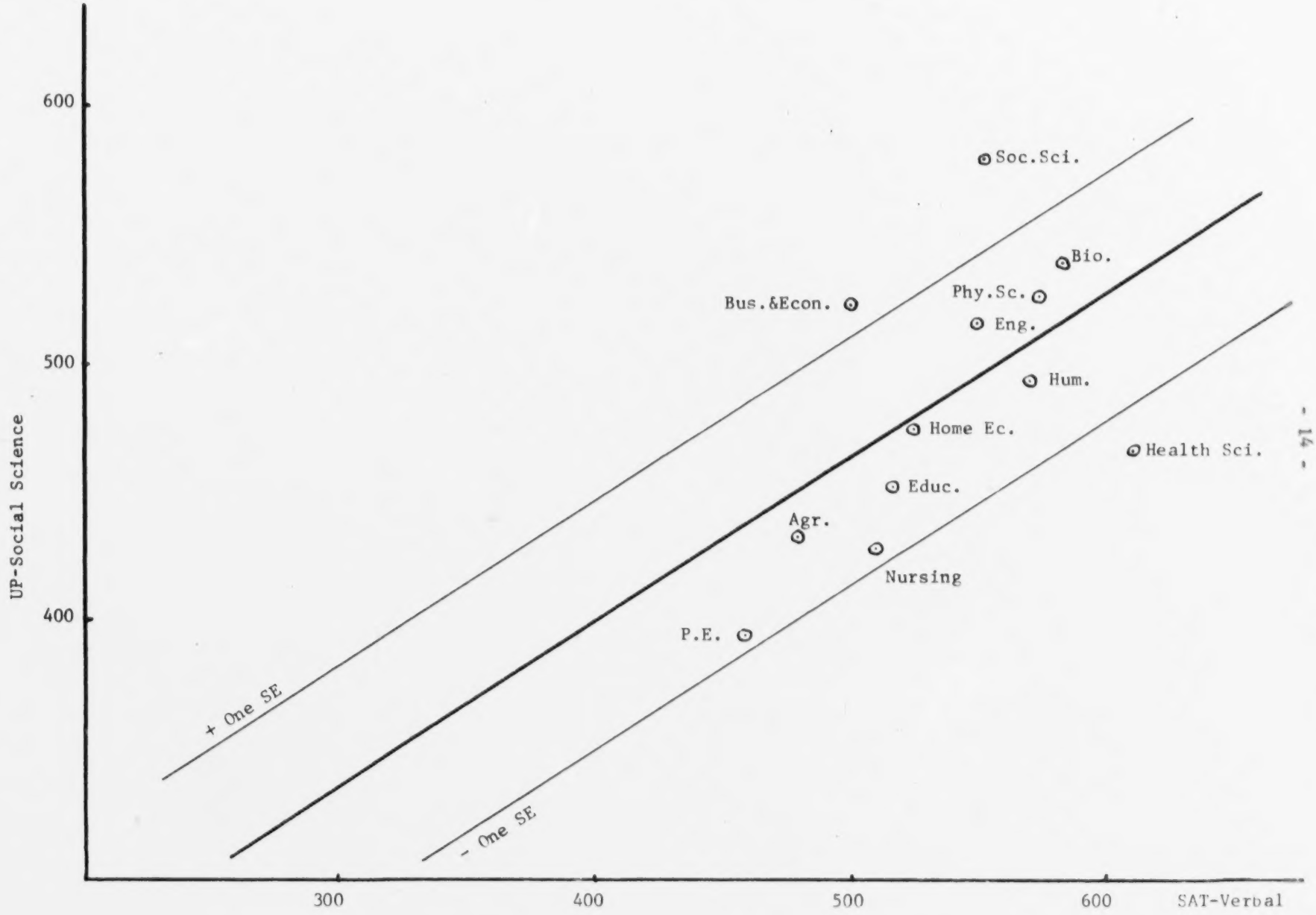

Fig. 4. Regression of UP-Social Science on SAT-Verbal

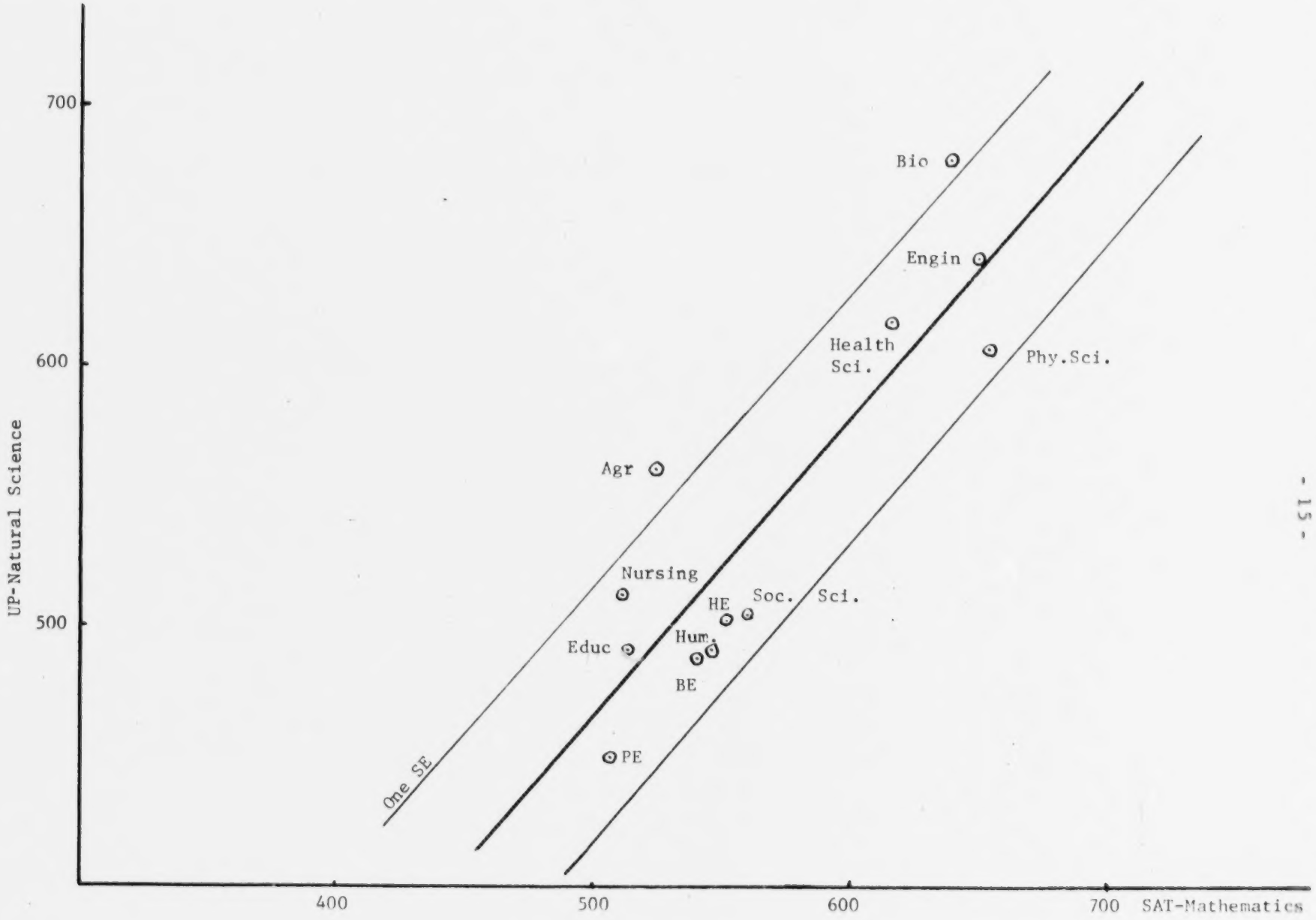

Fig. 5. Regression of UP-Natural Science on SAT-Mathematics

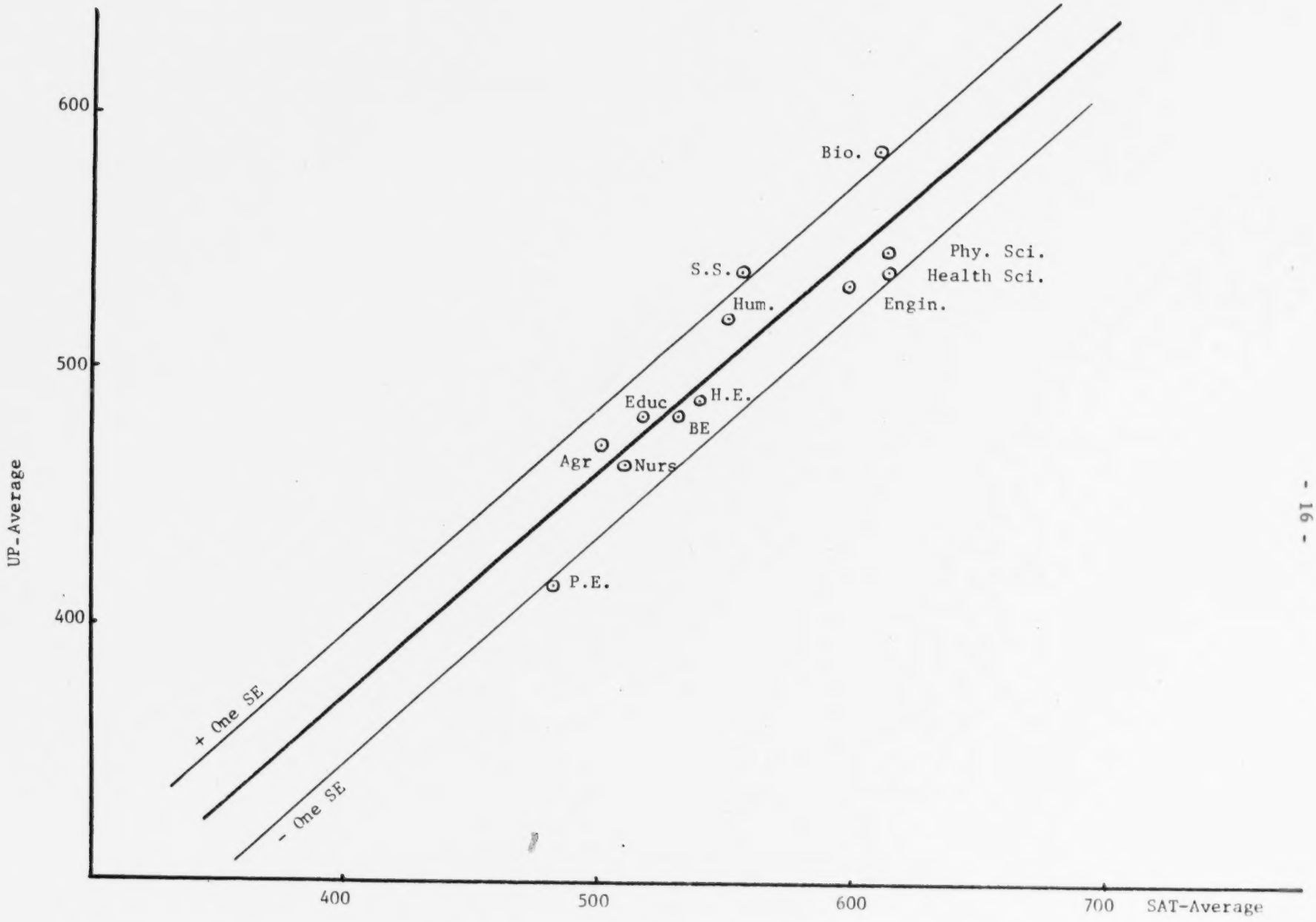

Fig. 6. Regression of UP-Average on SAT-Average

for those curriculum groups which were above the regression line for the total class have been drawn, one regression line approximately in the middle of the below-the-total curricula, and the line for the curriculum which is approximately furthest below the regression line for the total class.

Tables 10-13 show predicted Area Test scores for a student with SAT scores of 400, 500, and 600 in each curriculum group calculated by substituting these scores for X in the regression equations. These tables were prepared in an attempt to see which curricula were being relatively more successful with high-ability students, and which appeared to be getting better results with low- or average-ability students. These tables can also be used if anyone wishes to draw the regression line for a particular curriculum group not appearing in Figures 7 through 10.

Results

iii) Regression Equation Method Using Individual Scores

From Figure 7 it can be seen that the two curriculum groups with regression lines clearly above that for the total group, when predicting UP-Social Science scores from SAT-Verbal scores, are Social Science, and Business and Economics. Biology is just slightly above the regression line for the total, and closely parallels it. Humanities, Home Economics, Education, Agriculture, Nursing, and Physical Education all yield regression lines below that for the total.

From Figure 8 it appears that the curricula with regression lines above that for the total, when predicting UP-Humanities scores from SAT-Verbal are: Humanities, Social Science, Education and Biology. Of these Humanities clearly yields the regression line most markedly above that

for the total. Nursing, Engineering, Business and Economics, Physical Education, and Agriculture all yield regression lines below that for the total, Agriculture and Physical Education being the two furthest below.

Figure 9 shows that the curriculum groups with regression lines above that for the total when predicting UP-Natural Science scores from SAT-Mathematics are Biology, Engineering, Agriculture, and Physical Science. The regression line for Nursing is above the total line at the lower SAT-M levels, but below it at the higher levels.

Social Science, Humanities and Physical Education are the only three curriculum groups in which predicted UP-Natural Science scores are below the line for the total for SAT-M scores of 400, 500 and 600. Business and Economics, Home Economics and Education are below for SAT-M scores of 500 and 600, but above for scores of 400.

From Figure 10 it appears that only three curriculum groups yield regression lines above that for the total, when predicting UP-Average scores from SAT-Averages. The curriculum furthest above the total line is Biology, followed by Social Science and Humanities. The latter closely parallels the total line, only about 7 points above it. For only three curriculum groups are the predicted UP-Average scores for a student with SAT-Average scores of 400, 500 and 600 all below the regression line for the total. These curricula are Engineering, Nursing and Physical Education. Of these Physical Education is most markedly below the total. The slope for the Engineering regression line is somewhat different from that for other curricula, and for SAT-Average scores above 680 it crosses the line for the total group, and goes above it.

Table 7

Regression Equations of UP - Humanities on SAT-V for Various Curriculum Groups and the Total

Group	N	r	Equation: Y =	S.E.
Humanities	99	.75	.6597 X +206.2	54.5
Social Science	149	.55	.4837 X +266.8	66.3
Biology	36	.65	.7545 X +105.6	72.4
Physical Sci.	50	.59	.5571 X +189.0	78.1
Agriculture	41	.56	.4837 X +187.4	61.8
Business & Ec.	139	.53	.5165 X +178.4	59.7
Education	118	.59	.5278 X +230.8	49.5
Engineering	93	.64	.5745 X +146.5	60.3
Home Economics	75	.56	.4873 X +221.4	52.6
Nursing	34	.79	.5667 X +159.1	33.3
Physical Educ.	31	.58	.5698 X +140.8	59.0
Arts & Sci. Total	334	.60	.5714 X +223.3	70.2
Professional Total	531	.59	.5557 X +174.3	60.3
Grand Total	873[1]	.63	.6472 X +147.9	69.6

1 8 Health Science majors included in Grand Total

Table 8

Regression Equations of UP - Natural Science on SAT-M for Various Curriculum Groups and the Total

Group	N	r	Equation: Y =	S.E.
Humanities	99	.48	.5146 X +210.1	86.6
Social Science	149	.52	.5200 X +214.1	71.1
Biology	36	.55	.5076 X +352.5	55.1
Physical Science	50	.55	.6212 X +202.8	87.6
Agriculture	41	.36	.3476 X +378.7	69.2
Business & Econ.	139	.25	.3132 X +312.7	87.8
Education	118	.49	.5757 X +195.2	77.9
Engineering	93	.42	.4999 X +299.8	73.3
Home Economics	75	.44	.4241 X +268.8	65.0
Nursing	34	.40	.3324 X +342.0	56.0
Physical Education	31	.43	.5097 X +191.7	90.9
Arts & Sci. Total	334	.61	.6995 X +130.7	86.4
Professional Total	531	.51	.5746 X +200.6	84.8
Grand Total	873[1]	.56	.6329 X +169.2	85.4

1 8 Health Science majors included in Grand Total

Table 9

Regression Equations of UP-Average on SAT-Average
for Various Curriculum Group and the Total

Group	N	r	Equation: Y=	S.E.
Humanities	99	.72	.7025 X +129.9	56.1
Social Science	149	.62	.5756 X +219.8	53.0
Biology	36	.61	.6370 X +198.8	54.5
Physical Sci.	50	.74	.6685 X +137.9	54.1
Agriculture	41	.64	.5931 X +173.9	48.7
Business & Eco.	139	.47	.5079 X +213.1	58.2
Education	118	.64	.6453 X +151.9	47.1
Engineering	93	.63	.8342 X +30.7	67.9
Home Economics	75	.62	.5153 X +207.8	43.2
Nursing	34	.77	.5561 X +179.2	29.8
Physical Educ.	31	.56	.5604 X +145.1	58.5
Arts & Sci. Total	334	.68	.6334 X +179.2	55.6
Professional Total	531	.67	.6468 X +140.5	50.5
Grand Total	873[1]	.70	.6856 X +131.2	54.4

1 8 Health Science majors included in Grand Total

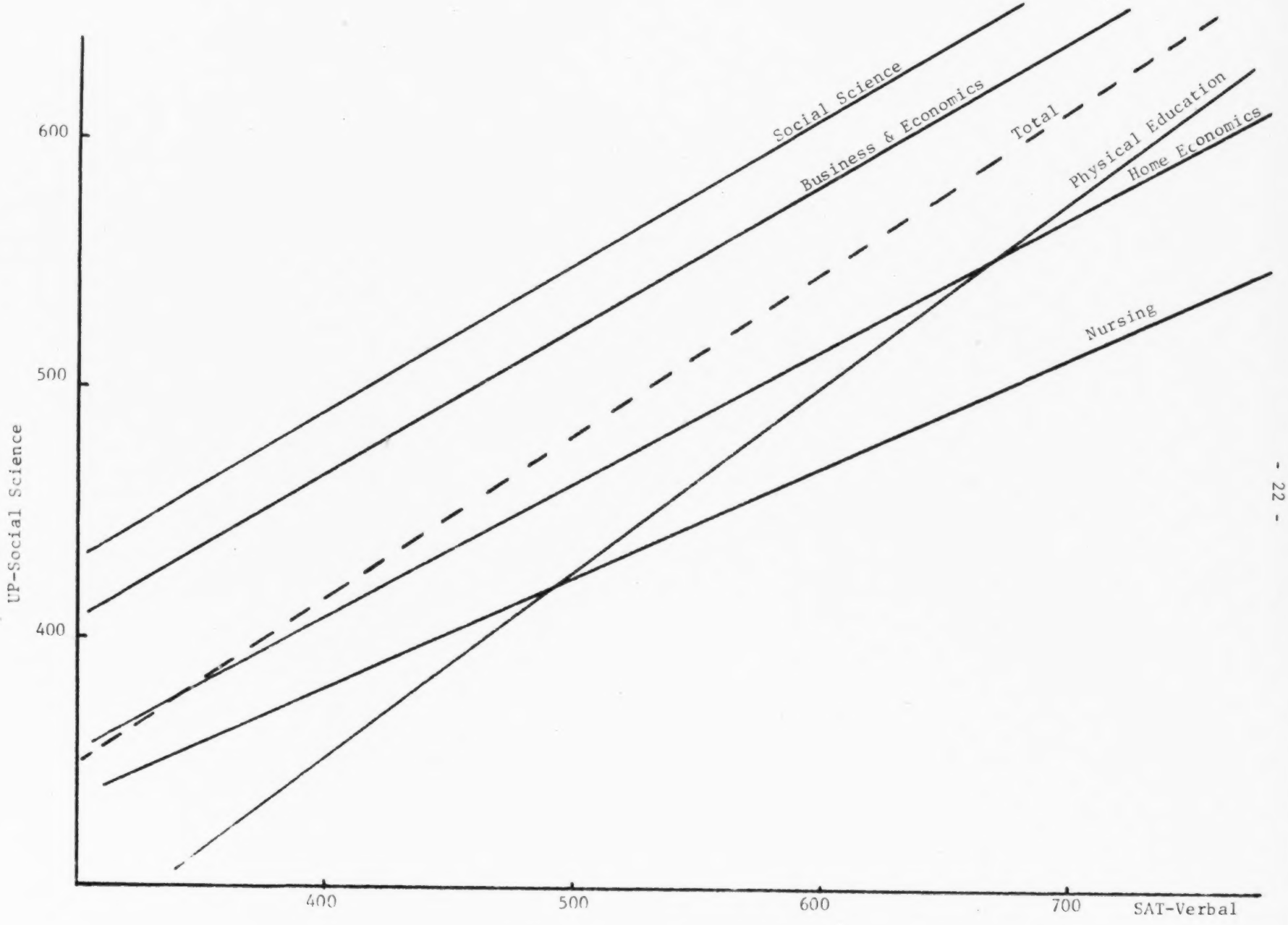

Fig. 7. Regression of UP-Social Science on SAT-Verbal for selected curriculum groups.

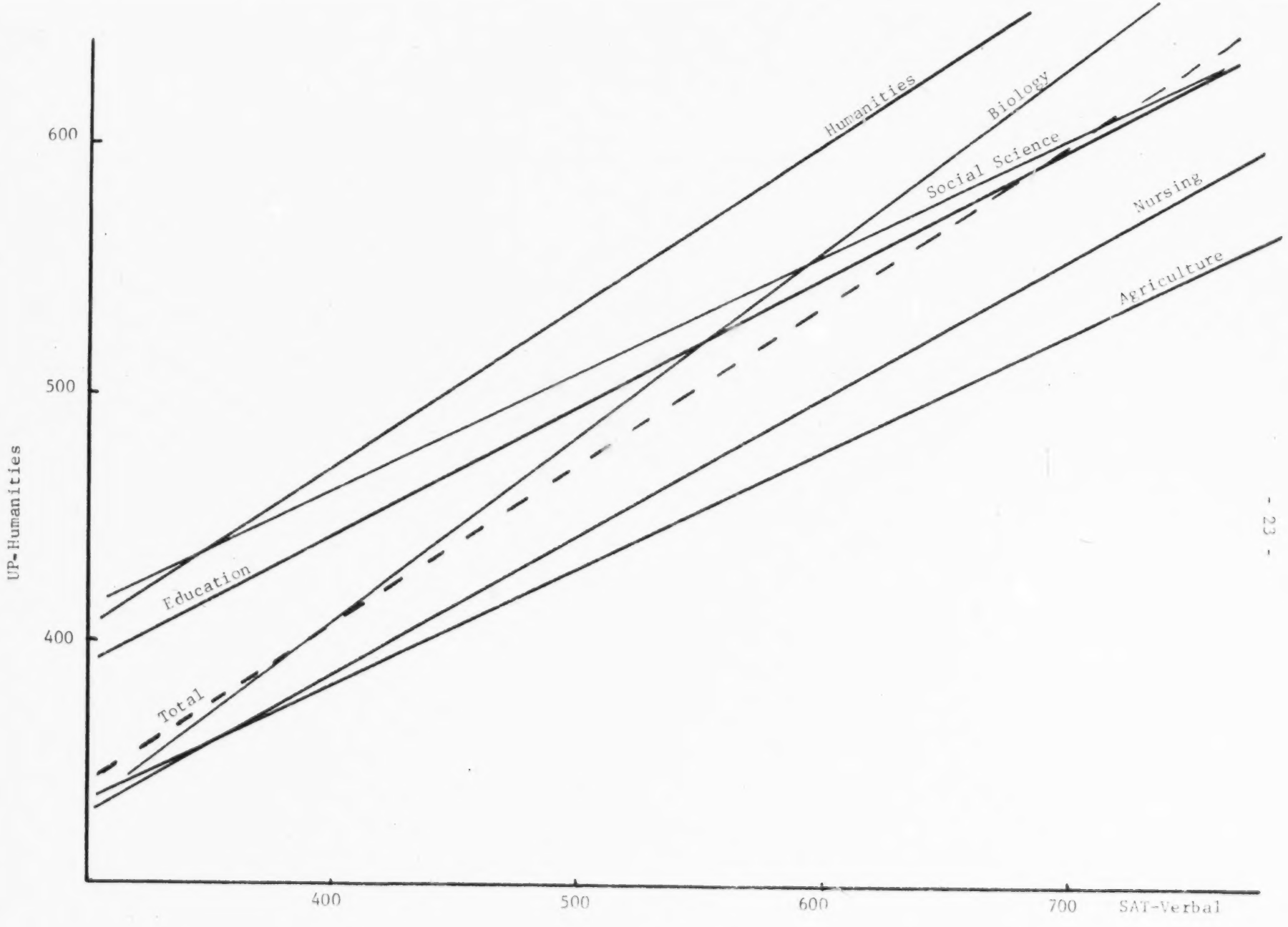

Fig. 8. Regression of UP-Humanities on SAT-Verbal for selected curriculum groups.

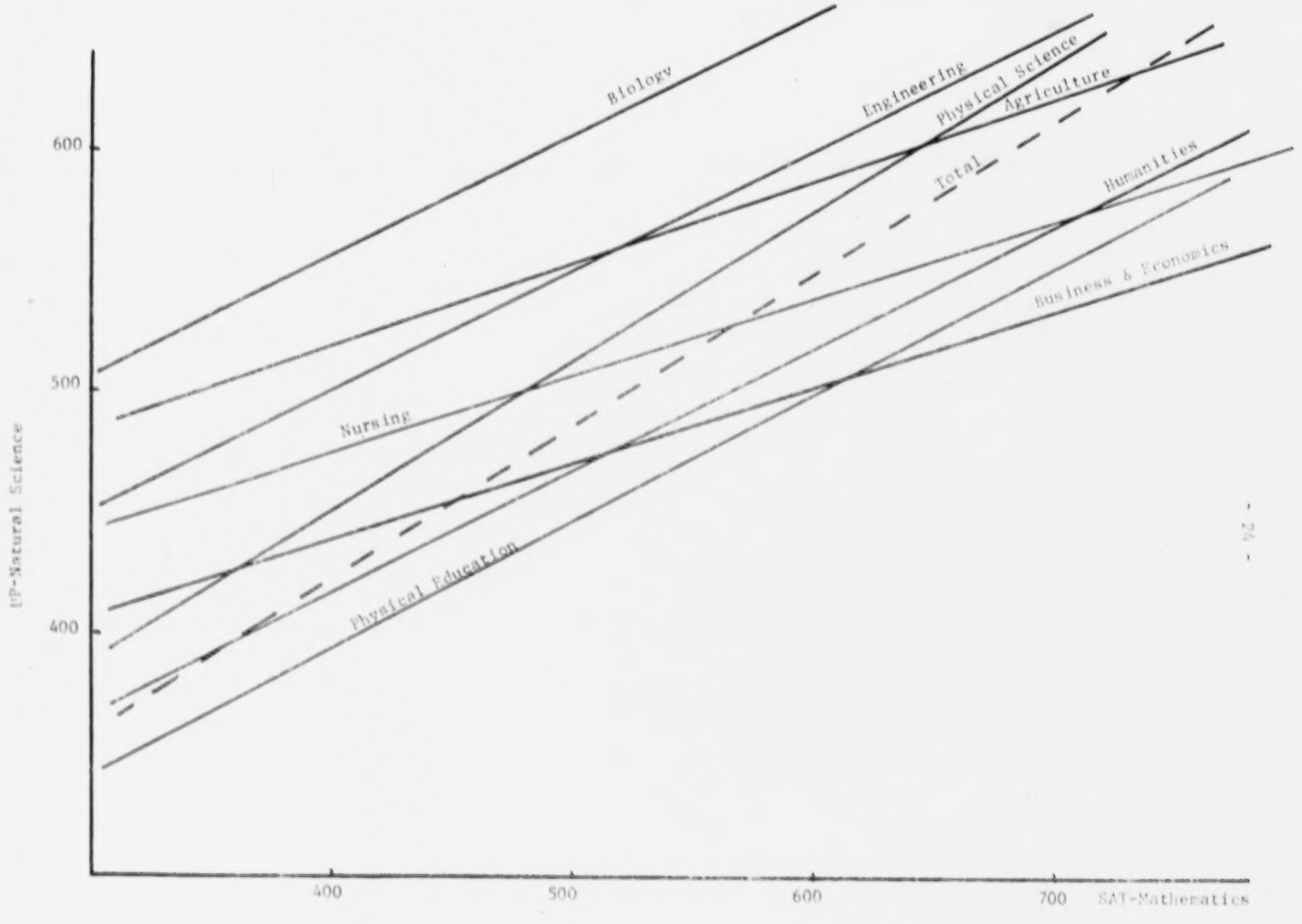

Fig. 9. Regression of UP-Natural Science on SAT-Mathematics for selected curriculum groups

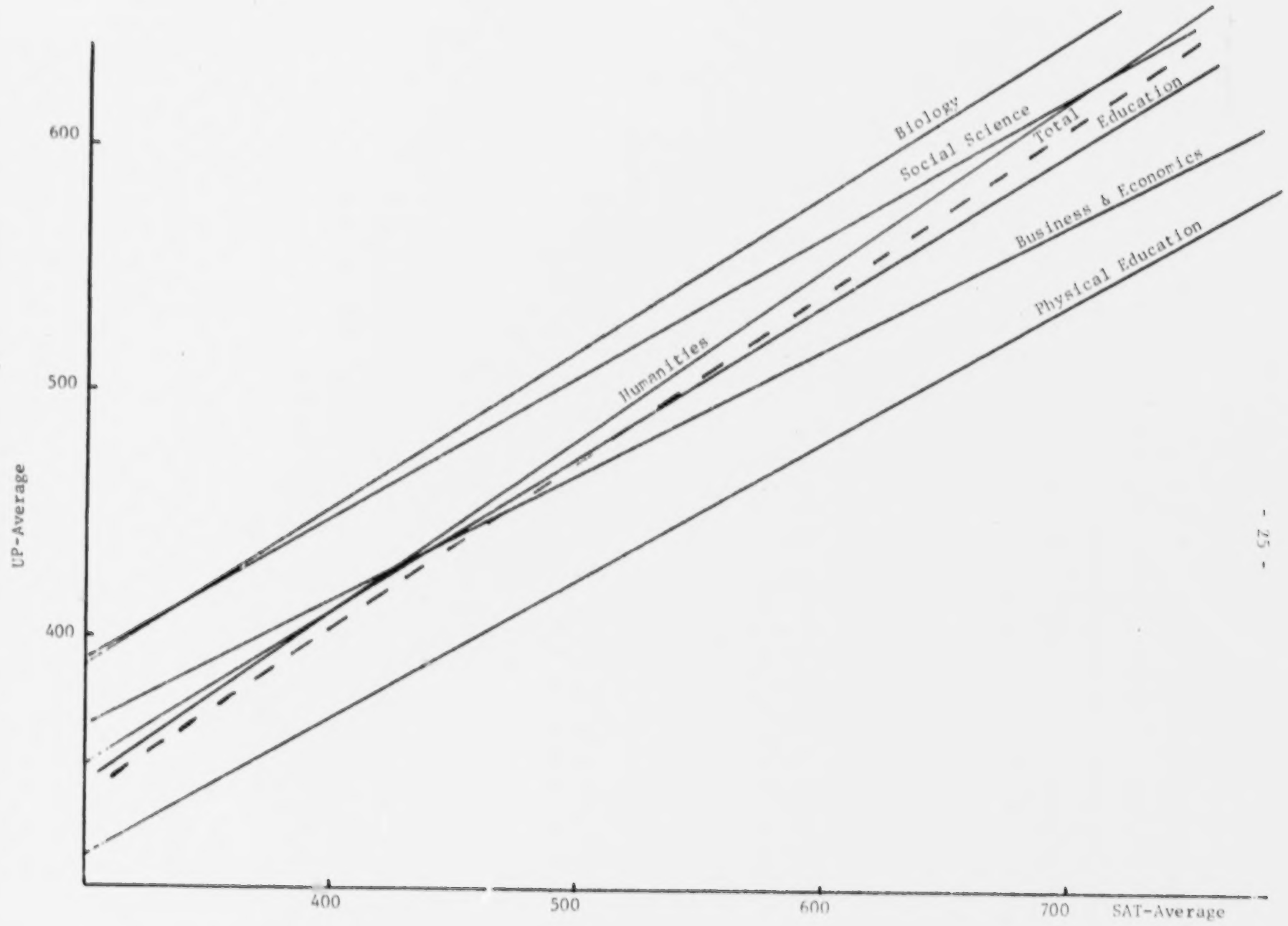

Fig. 10. Regression of UP-Average on SAT-Average for selected curriculum groups.

Discussion of Results

In order to combine the results obtained by all three statistical methods, Table 14 was prepared. In this table the SAT-V score was used as the predictor of the UP-Social Science score for all three methods. It is interesting to note that Centra and Parry[1] using group means for different groups of colleges, found that SAT-M predicted Social Science scores better than SAT-V in each of three different groups of colleges. However, in a later study, correlating individual scores, Centra, Linn and Parry[2] found in both Negro and white colleges that SAT-V predicted Social Science scores better than SAT-M. We found the same thing, SAT-M predicting Social Science scores best when using the group-mean technique, but SAT-V predicting Social Science scores best when using the individual-score technique with the same data.

From Table 14 it would appear that the two curriculum groups with the greatest exposure to Social Science courses (i.e. Social Science, and Business and Economics) were the two groups making scores above prediction levels on the Social Science test.

On the Humanities test Humanities and Education majors were the two groups scoring better than predicted by all three methods. Both these curricula are exposed to a large number of Humanities courses. Social Science majors score somewhat higher than predicted, using the stanine-difference method and individual-score regression method. Social Science students usually take a large number of Humanities courses, either as electives or group requirements.

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[1] Centra, John A. and Parry, Mary E. College Achievement in Social Science, Humanities and Natural Science: An Exploratory Study, Research Bulletin RB-67-23, Educational Testing Service, Princeton, N.J., June 1967.

[2] Centra, John A.: Linn, Robert L. and Parry, Mary E. Academic Growth in Predominantly Negro and Predominantly White Colleges. American Educational Research Journal, 1970, 7, pg. 83-98.

Table 10

Prediction of UP-Social Science scores
for a student with SAT-V scores of
400, 500 and 600 in various curriculum groups

r between SAT-V and UP-SS	SAT-V 400		SAT-V 500		SAT-V 600	
	Curric.	Most Probable UP-SS	Curric.	Most Probable UP-SS	Curric.	Most Probable UP-SS
Soc.Sci. .54	Soc. Sci.	490	Soc. Sci.	550	Soc. Sci.	609
Bus.& Ec. .50	Bus.& Ec.	465	Bus.& Ec.	524	Bus.& Ec.	583
Phy.Sci. .60	Phys.Sci.	430	Phys.Sci.	486	Engin.	553
Biology .61	Biology	420	Biology	486	Biology	552
Total .58	Total	415	Engin.	482	Total	548
Engin. .67	Engin.	410	Total	481	Phys.Sci.	542
Home Ec. .56	Home Ec.	407	Home Ec.	461	Hum.	516
Agric. .64	Agric.	393	Agric.	445	Home Ec.	515
Nursing .67	Nursing	380	Human.	443	Educ.	512
Hum. .68	Human.	371	Educ.	440	Phys.Ed.	502
Educ. .64	Educ.	367	Phys.Ed	427	Agric.	497
Phys.Ed. .68	Phys.Ed.	351	Nursing	424	Nursing	469

Table 11

Prediction of UP-Humanities Scores for a Student with SAT-V Scores of 400, 500 and 600 in Various Curriculum Groups

r between SAT-V and UP-Hum.		SAT-V 400		SAT-V 500		SAT-V 600	
		Curric.	Most Prob-able UP-Hum.	Curric.	Most Prob-able UP-Hum.	Curric.	Most Prob-able UP-Hum.
Hum.	.75	Hum.	470	Hum.	536	Hum.	602
Soc. Sci.	.55	Soc. Sci.	460	Soc. Sci.	509	Bio.	558
Educ.	.59	Educ.	442	Educ.	495	Soc. Sci.	557
Home Ec.	.56	Home Ec.	416	Bio.	483	Educ.	548
Phy. Sci.	.59	Phy. Sci.	412	Total	472	Total	536
Bio.	.65	Bio.	407	Phy. Sci.	468	Phy. Sci.	523
Total	.63	Total	406	Home Ec.	465	Home Ec.	514
Nursing	.79	Nursing	386	Nursing	442	Nursing	499
Bus. & Ec.	.53	Bus.& Ec.	385	Bus.& Ec.	437	Engin.	491
Agric.	.56	Agric.	381	Engin.	434	Bus.& Ec.	488
Engin.	.64	Engin.	376	Agric.	429	Phys. Ed.	483
Phys. Ed.	.58	Phy. Ed.	369	Phy. Ed.	426	Agric.	478

Table 12

Prediction of UP-Natural Science Scores for a Student with SAT-M Scores of 400, 500 and 600 in Various Curriculum Groups

r between SAT-M and UP-NS		SAT-M 400		SAT-M 500		SAT-M 600	
		Curric.	Most Probable UP-NS	Curric.	Most Probable UP-NS	Curric.	Most Probable UP-NS
Biology	.55	Biology	556	Biology	606	Biology	657
Agric.	.36	Agric.	518	Agric.	553	Engin.	600
Engin.	.42	Engin.	500	Engin.	550	Agric.	587
Nursing	.40	Nursing	475	Phy. Sci.	513	Phy. Sci.	576
Phy. Sci.	.55	Phy. Sci.	451	Nursing	508	Total	549
Home Ec.	.44	Home Ec.	438	Total	486	Nursing	541
Bus. & Ec.	.25	Bus. & Ec.	438	Educ.	483	Educ.	541
Educ.	.49	Educ.	426	Home Ec.	481	Soc. Sci.	526
Total	.56	Total	422	Soc. Sci.	474	Home Ec.	523
Soc. Sci.	.52	Soc. Sci.	422	Bus.& Ec.	469	Hum.	519
Hum.	.48	Hum.	416	Hum.	467	Bus.& Ec.	501
Phys. Ed.	.43	Phys. Ed.	396	Phys. Ed.	447	Phys. Ed.	498

Table 13

Prediction of UP-Average Scores for a Student with SAT-Av. Scores of 400, 500 and 600 in Various Curriculum Groups

r between SAT-Av. and UP-Av.		SAT-Av. 400		SAT-Av. 500		SAT-Av. 600	
		Curric.	Most Probable UP-Av.	Curric.	Most Probable UP-Av.	Curric.	Most Probable UP-Av.
Bio.	.61	Bio.	454	Bio.	517	Bio.	581
Soc. Sci.	.62	Soc. Sci.	450	Soc. Sci.	508	Soc. Sci.	565
Bus.& Ec.	.47	Bus.& Ec.	416	Hum.	481	Hum.	551
Home Ec.	.62	Home Ec.	414	Educ.	475	Total	543
Hum.	.72	Hum.	411	Total	474	Phy. Sci.	539
Agric.	.64	Agric.	411	Phy. Sci.	472	Educ.	539
Educ.	.64	Educ.	410	Agric.	471	Engin.	531
Phy. Sci.	.74	Phy. Sci.	405	Bus.& Ec.	467	Agric.	530
Total	.70	Total	405	Home Ec.	466	Bus.& Ec.	518
Nursing	.77	Nursing	402	Nursing	457	Home Ec.	517
Phys.Ed.	.56	Phys.Ed.	369	Engin.	448	Nursing	513
Engin.	.63	Engin.	364	Phys.Ed.	425	Phys.Ed.	481

Table 14

Higher and Lower Performing Curriculum Groups as Indicated by UP Area Tests and Three Different Statistical Techniques[1]

UP Area Test	Stanine Method	Group-Mean Regression Method	Individual Score Regression Method	Appearing on all Three Methods
	Higher Performing Curriculum Groups			
Soc. Sci.[2]	Soc. Sci.; Bus. & Ec.	Soc. Sci.; Bus. & Ec.	Soc. Sci.; Bus.& Ec.;Bio.	Soc. Sci.; Bus. & Ec.
Humanities	Hum.; Educ.; Soc. Sci.	Hum.; Educ.	Hum.; Educ.; Soc. Sci.;Bio.	Hum.; Educ.
Natural Sci.	Bio.; Agric.; Educ.; Nursing	Bio.; Agric.	Bio.; Agric.; Engin.; Phy.Sci.	Bio.; Agric.
UP Average	Soc. Sci.	Soc. Sci.; Bio.	Bio.; Soc.Sci.; Hum.	Soc. Sci.
	Lower Performing Curriculum Groups			
Soc. Sci.[2]	Educ.; Hum.; Phys.Ed.; H.E.; Nursing		Hum.; Home Ec.; Agric.; Educ.; Nursing; P.E.	
Humanities	Phy.Sci.; B.E.; Engin.	Engin.	Nursing; B.E.; Engin.; Agric.; Phys. Ed.	Engin.
Natural Sci.	Bus. & Ec.		Soc. Sci.; Hum.; Phys. Ed.	
UP Average	Phy. Sci.; Engin.	Phys. Ed.	Engin.; Nursing; Phys. Ed.	

1 The Health Science group was not included in this table because of the small number of cases involved.

2 SAT-V was used as the predictor for all three methods in this table.

The two curricula showing scores better than prediction by all three methods on the Natural Science test were Biology and Agriculture. Nursing and Education had higher scores using the stanine-difference method. Engineering and Physical Science had regression lines above the total, using the individual-score regression method. These are all curricula exposed to a large number of science courses. Biology and Agriculture are probably the two curricula exposed to the largest number of Biological Science courses, and this would account for the fact that these are the only two curricula that give results which are better than prediction by all three methods.

Tables 10-13 were prepared in an effort to see which curriculum groups were more successful with students who scored relatively low on the SAT tests, which curricula were more successful with high-scoring students and which were successful or unsuccessful with all levels of initial ability. Table 13 shows the most probable UP-Average score for a student with an average SAT-score of 400, of 500 or of 600, in eleven curriculum groups, and for the total class. An examination of this table indicates that Biology, Social Science and Humanities majors all score better than the class average at all three levels of initial competence. Business and Economics, on the other hand appears to be more successful with low-scoring students, and, relative to other curriculum groups, not quite as successful with students who entered the University with an average SAT-score of 600. Engineering students had average UP-scores somewhat lower than the class average at each level of initial competence, but the under-achievement seems to be greatest with the students scoring low on the SAT. Physical Education and Nursing tend to score lower than

the class total at all three levels of initial competence. An analysis similar to this can be made for the prediction of UP-Social Science and UP-Humanities scores from SAT-Verbal scores, by examining Tables10 and 11; and for the prediction of UP-Natural Science scores from SAT-Math scores by examining Table 12.

Table 15 was prepared to compare the relative standings of the curriculum groups on the UP Area Tests for the senior class of 1971, with their standings obtained two years previously from the senior class of 1969. The curricula which have most markedly gone up in their relative standing since 1969 are Biology and Engineering, followed by Education and Physical Science. Averaging the three stanine increases Biology went up .64, Engineering. 50, Education .21, and Physical Science .18. Home Economics, Physical Education and Nursing are the three curriculum groups which show the greatest drop in average stanines between 1969 and 1971. Home Economics dropped .45 of a stanine averaged over the three Area Tests, Physical Education .27, and Nursing .25.

Summary and Conclusions

Using SAT-scores as a means of controlling for student input, three different statistical methods were used to estimate the relative productivity of various curriculum groups. Scores on the UP Area Tests administered towards the end of the senior year were used as the criteria of achievement in social science, humanities and natural science. On the Social Science Area Test majors in Social Science, and Business and Economics made better scores than predicted by all three methods. On the Humanities test Humanities and Education were the two curriculum groups consistently scoring better than prediction. On the Natural Science test Biology and Agriculture majors had scores which, by all three procedures,

Table 15

DIFFERENCE BETWEEN 1969 and 1971 UGRE STANINES

Curriculum Group	Test	1969 N	1969 Stan.	1971 N	1971 Stan.	d 1971-1969
Biology	S.S.	61	5.28	36	5.75	.47
	Hum.		5.43		6.17	.74
	N.S.		6.95		7.67	.72
Physical Science	S.S.	61	5.39	50	5.52	.13
	Hum.		5.25		5.30	.05
	N.S.		6.16		6.52	.36
Humanities	S.S.	116	4.92	99	4.81	-.11
	Hum.		6.90		6.85	-.05
	N.S.		4.07		4.31	.24
Social Sciences	S.S.	126	6.44	149	5.93	-.51
	Hum.		5.60		5.66	.06
	N.S.		4.33		4.69	.36
Agriculture	S.S.	40	4.28	41	3.56	-.72
	Hum.		3.15		3.34	.19
	N.S.		5.25		5.68	.43
Business & Econ.	S.S.	79	5.20	139	5.44	.24
	Hum.		3.71		3.78	.07
	N.S.		4.27		4.28	.01
Education	S.S.	68	3.96	118	3.97	.01
	Hum.		4.93		5.31	.38
	N.S.		4.10		4.33	.23
Engineering	S.S.	89	4.63	93	5.31	.68
	Hum.		3.83		4.33	.50
	N.S.		6.40		6.72	.32
Home Economics	S.S.	49	4.80	75	4.55	-.25
	Hum.		5.22		4.69	-.53
	N.S.		5.12		4.56	-.56
Nursing	S.S.	27	3.78	34	3.50	-.28
	Hum.		4.37		4.03	-.34
	N.S.		5.00		4.85	-.15
Physical Education	S.S.	16	2.75	31	2.71	-.04
	Hum.		3.50		3.03	-.47
	N.S.		3.81		3.52	-.29

were higher than anticipated. Only Social Science majors yielded average UP Area Test scores higher than would have been predicted by their average SAT scores by all three methods. Engineering majors scored less well than originally predicted on the Humanities Test.

Tables were prepared to show which curriculum groups were more successful with students scoring high on the SAT tests, which were more successful with students scoring relatively low, and which showed over- or under-achievement at all SAT levels. For the UP-average scores Biology, Social Science and Humanities were the three curriculum groups yielding predicted scores above the class total at all three SAT score levels studied (400, 500 and 600).

A comparison was made between the stanine scores for the various curriculum groups in 1971 with those obtained by the seniors in 1969. Overall Biology and Engineering had raised their average stanine on the three UP Area Tests the most, whereas Home Economics, Physical Education and Nursing were the three curriculum groups whose average stanine standing had fallen the greatest amount.

The present study shows that knowledge in the three principal areas of academic learning: the social sciences, the humanities and the natural sciences is, at least in part, dependent on the characteristics of the curriculum in which a student is enrolled. If initial ability is controlled the students with the greatest exposure to social science courses make the best scores in this area, those with the greatest exposure to humanities make better-than-predicted scores in this field, and those students with the greatest exposure to the natural sciences, particularly biology, score consistently better on the Natural Science Area Test.

Carol Pemberton
Academic Planning and Evaluation
September 19, 1972